

What is claimed is:

1. A smart antenna control system, comprising:

a smart antenna system for forming an antenna pattern suitable for signal reception by receiving mechanical or electrical antenna control signal and controlling a beam width, gain, and frequency characteristic;

a VSB demodulator for generating channel data for demodulating a VSB (Vestigial Side Band) signal received through the smart antenna system, generating channel data for the antenna pattern, and outputting the demodulated VSB signal in a transport packet form; and

an antenna controller for receiving the channel data and auto gain control information from the VSB demodulator and controlling the smart antenna system by using the auto gain control information and the channel information set as a specific value.

2. The digital TV receiving smart antenna control system of claim 1, wherein the channel data comprises the auto gain control information, demodulated I channel data, phase-tracked I channel data, FEC (forward error correction) error data, and a field sync signal.

3. The digital TV receiving smart antenna control system of claim 1, wherein the VSB demodulator comprises an auto gain controller for directly controlling a gain of RF (Radio Frequency) and a gain of IF (Intermediate Frequency) signal.

4. The digital TV receiving smart antenna control system of claim 3, wherein the auto gain controller comprises:

a tuner for tuning the gain of the RF signal by increasing or decreasing the gain of RF signal according to inputted RF auto gain control signal;

an IF auto gain controller for controlling the gain of the IF signal by increasing or decreasing the gain of IF signal according to inputted IF auto gain control signal;

a VSB receiving chip for generating the IF auto gain control signal and the RF auto gain control signal by using a reference value of a RF auto gain control signal and demodulated passaband or baseband receiving signal, and outputting the signals to the IF auto gain controller and the tuner.

5. The digital TV receiving smart antenna control system of claim 1, wherein the antenna controller comprises:

a channel information detector for receiving the channel data from the VSB demodulator and detecting the channel information so as to determine a predetermined channel condition;

an antenna direction acquisition controller for receiving the channel information and the channel condition information and acquiring the antenna direction;

an antenna direction tracking controller for receiving an acquisition signal of the antenna direction acquisition controller and the channel information and converging the antenna direction from a maximum signal power acquisition location to an optimal receiving location.

6. The digital TV receiving smart antenna control system of claim 5, wherein the channel information detector comprises:

a signal power detector for detecting and outputting the signal power information from I signal of the passaband or baseband signal, the IF gain, and RF gain in the channel data, and comparing the signal power information with a preset signal power reference value so as to output the signal power condition;

a multi-channel signal power detector for detecting and outputting the multi-channel signal power information from an equalizer input I channel data or a field sync signal in the channel data, and comparing the multi-channel signal power information with the preset multi-channel signal power reference value so as to output the multi-channel signal power condition;

a SNR detector for detecting SNR (signal-to-noise) information from FEC (forward error correction) input I channel data or field sync signal in the channel data, and comparing the SNR information with a preset SNR reference value so as to output SNR condition; and

a SER detector for detecting and outputting SER (segment error rate) information from FEC error value in the channel data, and comparing the SER information with preset SER reference value so as to output SER condition.

7. The digital TV receiving smart antenna control system of claim 6, wherein the signal power detector receives and squares the passband or baseband I signal, accumulates the squared value into a predetermined window size, and detects and outputs the signal power information.

8. The digital TV receiving smart antenna control system of claim 6, wherein signal power detector receives the passaband or baseband I signal and get an absolute value,

accumulates the absolute value into a predetermined window size, and detects and outputs the signal power information.

9. The digital TV receiving smart antenna control system of claim 6, wherein the multi-channel signal power detector comprises:

- a train sequence generator for detecting a train sequence from the field sync signal (nFSYNC) of a main signal;

- a multiplier for multiplying an output of the train sequence generator with an input signal;

- an integer extractor for extracting an integer from an output of the multiplier;

- a ghost power formalizer for formalizing and calculating ghost power from the integer extractor.

10. The digital TV receiving smart antenna control system of claim 6, wherein the multi-channel signal power detector comprises:

- a train sequence generator for generating a train sequence of a main signal and each multi-channel signal;

- a plurality of multipliers for multiplying the train sequence of the main and each multi-channel with the input signal;

- an integer extractor for extracting only an integer from each output of the plurality of multiplier; and

a ghost power formalizer for formalizing and calculating ghost power from the integer extractor.

11. The digital TV receiving smart antenna control system of claim 6, wherein the SNR detector calculates the a MSE (mean square error) value from the received field sync signal and train sequence, and finding and outputting SNR information by using MSE value.

12. The digital TV receiving smart antenna control system of claim 6, wherein the SNR detector calculates MSE value from demodulated and equalized I channel data and decision constellation and obtaining and outputting SNR information by using MSE value.

13. The digital TV receiving smart antenna control system of claim 6, wherein the antenna direction acquisition controller continuously determines whether to proceed the antenna direction tracking process by selectively assembling channel condition information outputted from the channel information detector or to repeat the antenna direction reacquisition process, and receives SYNCLOCK signals before EQ and before FEC and determines an initialization of the channel equalization.

14. The digital TV receiving smart antenna control system of claim 6, wherein antenna direction acquisition controller rotates the antenna direction 360° for confirming whether a receiving signal exists by controlling the smart antenna system, and rotates the antenna 360°

from the antenna direction having the receiving signal for acquiring the maximum signal power direction so as to start the antenna tracking process.

15. The digital TV receiving smart antenna control system of claim 6, wherein the antenna direction acquisition controller comprises:

- an antenna scan processor for receiving the signal power channel condition information from the channel information detector and outputting necessary control signals;

- a timer for calculating delay time in each process of the antenna scan processor;

- an antenna pattern count register for counting pattern number of the smart antenna in the antenna direction acquisition process;

- a signal power register for storing the signal power information;

- a maximum signal power register for storing the maximum signal power value and the antenna direction; and

- an antenna direction register for storing the antenna direction information.

16. The digital TV receiving smart antenna control system of claim 4, wherein the antenna direction tracking controller comprises:

- a signal power tracking error detector for regularly receiving the signal power information from the channel information detector, and outputting the antenna convergence direction by observing a signal power change according to the antenna direction change;

- a multi-channel signal power tracking error detector for regularly receiving the multi-channel signal power information from the channel information detector, and outputting the

antenna convergence direction by observing a multi-channel signal power change according to the antenna direction change;

a SNR tracking error detector for regularly receiving SNR information from the channel information detector and outputting the antenna convergence direction by observing a multi-channel signal power change according to the antenna direction change; and

an error integrator for accumulating errors by selectively assembling the antenna convergence information of the tracking error detector, and outputting the antenna control signal so as to converge the accumulated error to an optimal antenna direction around the antenna direction of the maximum signal power acquisition location.

17. A digital TV receiving smart antenna control system, comprising:

the smart antenna system forming an optimal antenna pattern for a signal reception by controlling the antenna through an antenna control signal;

a tuner for tuning only a specific RF signal in RF (Radio Frequency) signal received through a smart antenna system, and converting the signal into an IF signal after automatically controlling RF gain tuned according to RF gain control signal;

a VSB (Vestigial Side Band) demodulator for demodulating after controlling the IF (Intermediate Frequency) signal gain according to IF gain control signal;

a channel information detector for detecting channel information such as signal power, multi-channel signal power, SNR (signal-to-noise ratio), and SER (Segment Error Rate) outputted from the VSB demodulator, determining the channel condition and outputting the channel information and the channel conditions; and

an antenna direction acquisition controller for receiving signal power condition, multi-channel signal power condition, SNR condition, SER condition, and signal power information from the channel information detector and detecting and outputting an antenna direction of the maximum signal power, fixing the RF gain control signal and IF gain control signal in acquisition process, and changing the signals according to the receiving signal in a tracking process.

18. The digital TV receiving smart antenna control system of claim 17, wherein the channel information detector comprises:

a signal power detector for receiving passband and baseband I signal from the VSB demodulator, detecting the signal power information, and comparing the signal power information with the signal power reference value so as to output the power condition;

a multi-channel signal power detector for receiving I channel data or a field sync signal equalized at the VSB demodulator, detecting multi-channel signal power information, and comparing the multi-channel signal power information with a preset multi-channel signal power reference value so as to output the multi-channel signal power condition;

a SNR detector for receiving I data or field sync signal detecting SNR (signal-to-noise) information from FEC (forward error correction) input I channel data or field sync signal in the channel data, and comparing the SNR information with a preset SNR reference value so as to output SNR condition; and

a SER detector for detecting and outputting SER (segment error rate) information from FEC error value in the channel data, and comparing the SER information with preset SER reference value so as to output SER condition.

19. The digital TV receiving smart antenna control system of claim 18, wherein the signal power detector comprises:

a squaring operator for receiving passband and baseband I signal from the VSB demodulator; and

an integrator for accumulating the squared value in a predetermined window size and detecting the signal power.

20. The digital TV receiving smart antenna control system of claim 18, wherein the signal power detector comprises:

an absolute operator for receiving the passband and baseband I signal from the VSB demodulator; and

an integrator for accumulating the absolute value in a predetermined window size and detecting the signal power.

21. The digital TV receiving smart antenna control system of claim 18, wherein the multi-channel signal power detector detects the multi-channel power information based on a correlation value of the field sync section when the multi-channel does not exist by using the field sync section of a main signal.

22. The digital TV receiving smart antenna control system of claim 18, wherein the multi-channel signal power information detector detects the correlation value by using field section of a primary multi-channel signals and a field section of the main signal, and detecting the multi-channel power information.

23. The digital TV receiving smart antenna control system of claim 18, wherein the SNR detector squares difference of the field sync signal and training sequence included in demodulated receiving signal, accumulates the calculation, and calculates an average to obtain MSE so as to apply the MSE value and detect SNR.

24. The digital TV receiving smart antenna control system of claim 18, wherein the SNR detector calculates MSE of received signal by squaring difference between the demodulated receiving signal and decision constellation, accumulates the calculation, detects SNR by applying the MSE value.

25. The digital TV receiving smart antenna control system of claim 18, wherein antenna direction acquisition controller determines whether to proceed the antenna direction tracking process by selectively assembling the signal power information, multi-channel signal power condition information, SNR condition information, and SER condition information outputted from the channel information detector or to repeat the antenna direction reacquisition process,

and receives SNCLOCK signals before EQ and before FEC, and determines an initialization of the channel equalization.

26. The digital TV receiving smart antenna control system of claim 17, wherein the antenna acquisition controller confirms whether the receiving signal exists by controlling the smart antenna system and rotating the antenna direction, and acquires the maximum signal power direction by rotating the antenna 360° from the antenna direction having the receiving signal so as to start the antenna tracking process.

27. The digital TV receiving smart antenna control system of claim 17, wherein the antenna direction acquisition controller comprises:

- an antenna scan processor for receiving the signal power channel condition information from the channel information detector and outputting necessary control signals;

- a timer for calculating delay time in each process of the antenna scan processor;

- an antenna pattern count register for counting pattern number of the smart antenna in the antenna direction acquisition process;

- a signal power register for storing the signal power information;

- a maximum signal power register for storing the maximum signal power value and the antenna direction; and

- an antenna direction register for storing the antenna direction information.

28. The digital TV receiving smart antenna control system of claim 17, further comprising an antenna direction tracking controller for receiving signal power information, multi-channel signal power information, SNR information from the channel information detector, generating an antenna control signal, outputting the signal to the smart antenna system, and converging the antenna direction from the maximum signal power acquisition location to the optimal receiving location.

29. The digital TV receiving smart antenna control system of claim 28, wherein the antenna direction tracking controller comprises:

- a signal power tracking error detector for regularly receiving the signal power information from the channel information detector, and outputting the antenna convergence direction by observing a signal power change according to the antenna direction change;

- a multi-channel signal power tracking error detector for regularly receiving the multi-channel signal power information from the channel information detector, and outputting the antenna convergence direction by observing a multi-channel signal power change according to the antenna direction change;

- a SNR tracking error detector for regularly receiving SNR information from the channel information detector and outputting the antenna convergence direction by observing a multi-channel signal power change according to the antenna direction change; and

- an error integrator for accumulating errors by selectively assembling the antenna convergence information of the tracking error detector, and outputting the antenna control signal

so as to converge the accumulated error to an optimal antenna direction around the antenna direction of the maximum signal power acquisition location.

30. The digital TV receiving smart antenna control system of claim 28, wherein the top value of an error accumulated to the error integrator is divided and converged into the antenna direction.

31. A method for controlling a digital TV receiving smart antenna, comprising the steps of:

(a) acquiring maximum signal power according to the antenna direction by using signal power information, multi-channel information, SNR information, and SER information extracted from an input signal; and

(b) converging the smart antenna into an optimal reception by selectively assembling the signal power information, the multi-channel information, the SNR information, and the SER information.

32. The method for controlling a digital TV receiving smart antenna of claim 31, wherein the step (a) comprises calculating the signal power according to the antenna direction by fixing the auto gain control value as a specific value and detecting the maximum signal power.

33. The method for controlling a digital TV receiving smart antenna of claim 31, wherein the step (a) comprises:

- (c) fixing the auto gain control value as a specific value;
- (d) confirming whether the receiving signal exists by rotating the antenna direction;
- (e) acquiring the maximum signal power direction by rotating the antenna 360° from a direction of the receiving signal; and
- (f) directing antenna tracking after acquiring the maximum signal power direction.

34. The method for controlling a digital TV receiving smart antenna of claim 31, further comprising the steps of:

- (g) watching whether the reception is good by referring the channel condition information; and
- (h) starting reacquisition process if the reception is not good.